WELLHEAD AREA SURVEY
ORLEANS VOLUNTEER FIRE DEPARTMENT
ACHD SITE NO. 102
Belle Grove, Allegany County, Maryland

ALWI Project No. AL7N001

1.0 INTRODUCTION

Advanced Land and Water, Inc. (ALWI) was retained by the Allegany County Health Department (ACHD), to prepare a Wellhead Area Survey for Orleans Volunteer Fire Department (the VFD), located on the east side of Orleans Road, 0.5 mile south of the National Freeway (Interstate Route 68) in eastern Allegany County, Maryland. The VFD holds periodic dinners, fund-raisers (e.g., bingo games) and other events. This site, designated No. 101 by ACHD, is served by one production well completed in the local bedrock aquifer.

The draft MDE "Transient Water Systems Operations Guidance" manual (herein termed the "Guidance Manual") defines a Non-Transient Non-Community (NTNC) Water System as one that "...serves at least 25 regular consumers over 6 months per year." No interviewees were available to describe usage patterns. However, considering that fires may occur at any time of year, this facility would have to be considered a NTNC system.

1.1 PURPOSE

The Safe Drinking Water Act (SDWA) of 1974 required the U.S. Environmental Protection Agency (EPA) to develop enforceable drinking water quality standards to protect the public health. In 1986, amendments made to the SDWA strengthened provisions for the protection of underground sources of drinking water. These amendments included provisions for establishing Wellhead Protection Programs by individual states under "umbrella" EPA oversight. The EPA approved a statewide Wellhead Protection Program developed by MDE in June 1991.

The MDE program originally applied to community water supplies, only. A newly proposed broadening of the federal Clean Water Act will have the result of expanding the MDE Wellhead Protection Program to encompass non-community supplies both transient and non-transient in nature. ACHD, in cooperation with MDE, established this program to bring existing non-community supplies into compliance with the coming regulations.

1.2 SCOPE

ALWI prepared this Wellhead Area Survey following ACHD requirements, which followed MDE guidelines for transient system operation and wellhead protection.

1. **Site Reconnaissance, Photographic Documentation and Interviews** – ALWI observed the on-site wellhead, storage, treatment, and distribution infrastructure to the degree exposed without

excavation or exposure to personal hazards. ALWI used an ACHD-owned digital camera to photograph conditions surrounding the wellhead at the time of the field reconnaissance. Said photographs are stored on ACHD's computer system. The facility was unoccupied at the time of ALWI's site check and repeated attempts to contact knowledgeable persons by telephone failed.

2. **Baseline Water Quality Assessment** - ALWI purged the water system and collected samples for analysis in the ACHD laboratory that is affiliated with the Maryland Department of Health and Mental Hygiene (DHMH). ALWI performed this fieldwork in accordance with MDE potable water sampling criteria including in-field measurements of turbidity, chlorine, and pH. ACHD selected the analyte list based on countywide experience with potability concerns and the capabilities of the aforementioned laboratory. The analytes included total and fecal coliform bacteria, nitrates, nitrites, iron, sulfur and manganese (Appendix A).

3. **Contamination Hazard Assessment** – ALWI identified existing and potential contaminant hazards within the delineated area based on visual observations and the techniques enumerated above. ALWI ranked these hazards in term of relative risk and provided concrete suggestions for their appropriate address. More generally, herein ALWI provides specific recommendations for source reduction measures, contingency plans, and other methods that may help better protect against occurrences of groundwater contamination.

2.0 HYDROGEOLOGIC FRAMEWORK

ALWI used published information from the United States Geological Survey and the Maryland Geological Survey to identify and describe the characteristics of the local hydrogeologic setting.

2.1 BEDROCK GEOLOGY

The VFD is situated within the Appalachian Valley and Ridge physiographic province and is underlain by sedimentary rocks of late Devonian age. These rocks have been intensely folded and faulted, resulting in alternating synclines (concave-upward folds) and anticlines (convex-upward folds).

In three dimensions, the rock formations of such folds dip at right angles to the direction of plunge of the entire fold system. In general, dip directions may help govern groundwater (and contaminant) movement directions in the bedrock but plunge directions have no relation. At this location, the bedding planes dip gently to the east-southeast. Deep groundwater flow directions likely follow.

Reported local well yields are sparse but range from 5 to 10 gpm. Wells completed within sandstone generally have a higher yield because the greater competence of the rock allows the development of longer and wider fractures both along and across bedding planes.

2.2 SAPROLITE AND SOIL MANTLE

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Natural chemical weathering of the shallow portion of the bedrock, due to percolating water, has chemically altered many of the original rock-forming minerals to clays and other secondary minerals. This has resulted in the development of shallow saprolite (weathered bedrock) and the overlying soil mantle. The thickness of the soil and saprolite is generally 2 to 10 feet, but it varies considerably over short distances. In highly fractured zones, enhanced groundwater storage and movement has accelerated the breakdown of the rock-forming minerals and has caused formation of a thicker saprolitic deposit.

2.3 AQUIFER RECHARGE

Precipitation infiltrating through the soil on site and/or in up-gradient areas is the primary source of aquifer recharge to the on-site supply well. Generally, overlying soil horizons act to absorb and then slowly release infiltrating precipitation. However, in areas where fracture zones have formed, percolating groundwater can reach the water table quickly. A portion of the precipitation percolates downward through the soil mantle and then migrates through narrow, interconnected joints, fractures, faults, and cleavage planes in the bedrock.

2.4 GEOLOGY-CONTROLLED GROUNDWATER FLOW

Generally, bedding plane partings and cross-bedding fracture zones (where present) function as both downward and lateral water conduits. Consequently, such zones receive and transmit water at a rate higher than would otherwise be achievable and, accordingly, are preferential conduits for groundwater flow and contaminant transport.

Despite the bedrock's overall hardness and resistance to erosion, hydraulic permeabilities in bedding planes and fracture zones within the Hampshire Formation may be several times greater than in surrounding less-fractured rock. This intrinsic characteristic portends the possibility for the existence of specific zones with higher-than-normal well yields, higher-than-normal groundwater flow velocities and higher-than-normal susceptibility to groundwater contamination.

3.0 WATER QUALITY ASSESSMENT

Slaughter and Darling (1962) reported the regional water quality as slightly irony (0.01 to as much as 0.12 micrograms per liter [mg/l]), soft (19 to 77 mg/l), and slightly acidic to moderately alkaline (pH range of 6.3 to 8.7). ALWI interpreted that the slight reddish colors of the local rock exposures as likely attributable to the trace presence of iron.

At this location, ALWI collected baseline groundwater samples on December 14, 1998, in accordance with the MDE sampling procedures specified in COMAR 26.08.05. ALWI collected the samples from a janitorial wash basin on the second floor. Because no site representatives were present and ALWI could not obtain access to the lower level of the building, the presence of disinfection and/or other treatment equipment could not be verified. Considering the project's timetable and budgetary constraints and absent direction from knowledgeable site representatives to the contrary, ALWI collected raw water samples from the sink as specified in COMAR 26.04.01.14. ACHD's laboratory analyzed the samples for those constituents of countywide concern. These included total coliform bacteria as specified in COMAR 26.04.01.11A-C, alkalinity, color, conductance, hardness, iron, manganese, nitrate-nitrite nitrogen (COMAR 26.04.01.14(4)(a)), nitrite nitrogen (COMAR 26.04.01.14(4)(b)), pH, and total dissolved solids.

The results are included as Appendix A, and suggest potability with respect to the analyses performed. The supply appears to be at low risk for surface water influence as defined in the MDE guidance document. The analyses documented herein may obviate the risk if a 50 foot casing depth can be verified.

4.0 DELINEATION

ALWI delineated a surveyed area surrounding this site's well using generalized criteria developed by MDE for non-community supplies, as modified by ALWI (with ACHD consent) based on the specific topographic setting of the site. ALWI began by using a fixed radius of 1,000 feet around the well but noted that the site is located on a topographic knoll. Considering the rural setting and modest and occasional demand, ALWI herein considered the property boundary as the effective limit of the surveyed area.

The resultant delineation is shown on the "Water Plant Information" survey form (Appendix B) and encompasses approximately 8% of the circle (originally 72 acres in size) or 5 acres. Within an assumed 600 gallons per day per acre (gpd/ac) of annualized groundwater recharge (Slaughter and Darling, 1962, Table 37), over 3,000 gallons per day exists within the aquifer beneath this surveyed area. In actuality, the modest demand of this well (doubtlessly less than 300 gpd) is more than one full order of magnitude smaller than the surveyed area, lending a high degree of conservatism to this analysis.

Negligible nitrate-nitrogen concentrations were detected in the sample ALWI collected. This obviated the need for a nitrate balance assessment.

5.0 CONTAMINANT THREATS ASSESSMENT

ALWI performed a site reconnaissance on December 14, 1998. During the reconnaissance, local land use conditions were observed with emphasis on the potential use, storage and disposal practices of hazardous materials and petroleum products. Such conditions may have included visual evidence for present or former spills, stained or discolored ground surfaces, stressed vegetation, unusual odors, or visible underground storage tank (UST) facilities. Adjacent and nearby properties were also visually scanned for such evidence from the property and nearby public right-of-ways. Off-site properties were not entered. No interview information was available to corroborate these limited observations.

Design, construction and present condition are important factors in determining a well's susceptibility to contamination. However, no well tag was visible. Accordingly, ALWI could not assess the initial design nor present condition of the casing or grout seal. ALWI observed that the top of the casing terminates in a non-watertight subsurface vault, in apparent violation of several provisions[1] within COMAR 26.04.04.07F. Stormwater and other liquids may accumulate in this vault and enter the well, entraining microbial contaminants from the dark recesses of the vault as well as various other potential contaminants. Extension of the casing to above natural grade would provide greater protection against possible contamination.

Based solely on visual observation and in the absence of interview information, ALWI identified the following potential sources of contamination within the surveyed area: possible remnant surficial and subsurface fuel spills from possible former USTs[2], possible stormwater infiltration along the well's casing, salt from parking lot deicing, and the aforementioned risks associated with the well's subsurface completion.

5.0 CONCLUSION AND RECOMMENDATIONS

ALWI found that the supply is potable relative to the analyses performed. No discharge to groundwater has been confirmed by any of the facilities or practices ALWI observed. Nevertheless, ALWI provides recommendations to assess and mitigate the risk from the following hazards:

1. **Subsurface Well Completion** – The well should be retrofitted with a pitless adapter and casing extended to above-grade. The well vault should be backfilled with inert material taking care to adhere to casing grouting requirements in so doing. Access for pump repairs and replacements should be maintained as well.

2. **Remnant Petroleum from Former USTs** - Based solely on the age and architecture of the building, ALWI infers that fuel oil was a likely former heating source. Propane appears to fuel the facility at present but may not have been in use at the time of initial construction. Therefore, ALWI recommends a single round of analytical testing to confirm the absence of fuel oil constituents (e.g., naphthalene and total diesel-range petroleum hydrocarbon compounds). A geophysical survey for remnant USTs (an interview and regulatory file

[1] This regulation prohibits frost pits, requires pitless adapters, and specifies that the finished height of well casings extend at least 8 inches above natural grade.

[2] See conclusion No. 2.

reviews to confirm their absence) could also be considered. Periodic monitoring and other corrective actions as necessary should then continue based on the findings.

3. **Roadway and Parking Area Deicing** – Highway and parking area deicing practices may increase a seasonal risk of sodium and chloride contamination. The Allegany County Roads Department is unlikely to curtail or otherwise change deicing practices. However, consideration should be given to using non-chemical abrasives on the parking lot for deicing to the degree possible. Baseline and bi-annual sampling for sodium and chlorides should be considered.

Depending on the results of the analyses indicated above, the VFD may find greater cost-effectiveness in converting to bottled sources of potable water. Retrofitting the existing groundwater supply with an extended casing may not be cost-effective considering the nature and quantity of on-site uses. If the site owner concurs, appropriate placarding should be provided so as to warn against use of an untested source for potable purposes.

6.0 SELECTED REFERENCES

MDE Public Drinking Water Program, 1998, Transient Water System Operations Guidance; Guidance For Counties With Delegated Responsibilities (Draft), 45p.

Slaughter, Turbit H. and John M. Darling, 1963, The Water Resources of Allegany and Washington Counties: Maryland Department of Geology, Mines, and Water Resources, Bulletin 24, p. 408.

NONCOMMUNITY WATER SUPPLY SANITARY SURVEY

1. System Name: Orleans Volunteer Fire Department

2. WAS: 101

3. System Information:

Address: ______

Little Orleans, Maryland

Phone No.: (301) 478-2229

4. ADC Map/Grid: N/A

5. Tax Map/Plat: N/A

6. Population:

Transient ______
Regular 25
Total 25+/-

7. Property Information:

Owner's Name Orleans Volunteer Fire Department

Address: ______
Little Orleans, Maryland

Phone No.: (301) 478-2229

8. No. Service Connections:

9. Type of Facility:

Food Service ______
Church ______
Campground ______
Daycare ______
Other (specify) Fire Department

10. Contact Person:

Name: ______

Phone No. ______

11. Operator:

Name: ______

Cert. No. ______

12. Sample History (Has the system had any violations?):

Bacteria: None apparent or reported

Nitrate: None apparent or reported

SURVEY RESULTS

13. Comments on System, Recommendations:

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14. Inspected by:	15. Date inspected:	16. System Vulnerability
Mark W. Eisner	12/14/98	Protected ______ Vulnerable ______

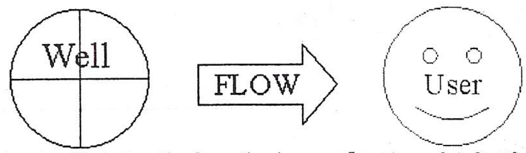
WATER PLANT INFORMATION

17. Type of Treatment:
(Check all that apply)

Disinfection
- Gas Chlorine: ______
- Sodium Hypochlorite ______
- Ultraviolet Radiation ______

Iron Removal ______
Nitrate Removal ______
PH Neutralizer ______
Other ______
Unknown ______

18. System Schematic (Process Flow):



NOTE: This diagram is a simplified schematic of operational process flow observed or described on the date of the reconnaissance. Many water systems possess malfunctioning, disconnected and/or occasionally/regularly-bypassed equipment. Actual treatment processes may differ, therefore, from those shown herein.

19. System Storage:

Ground Storage ______
Elevated Storage ______
Hydropneumatic Tank __x____
Other ______

20. Storage Capacity:

Typical Domestic

21. Untreated water sampling tap?

Yes __x__ No _____

WELL INFORMATION

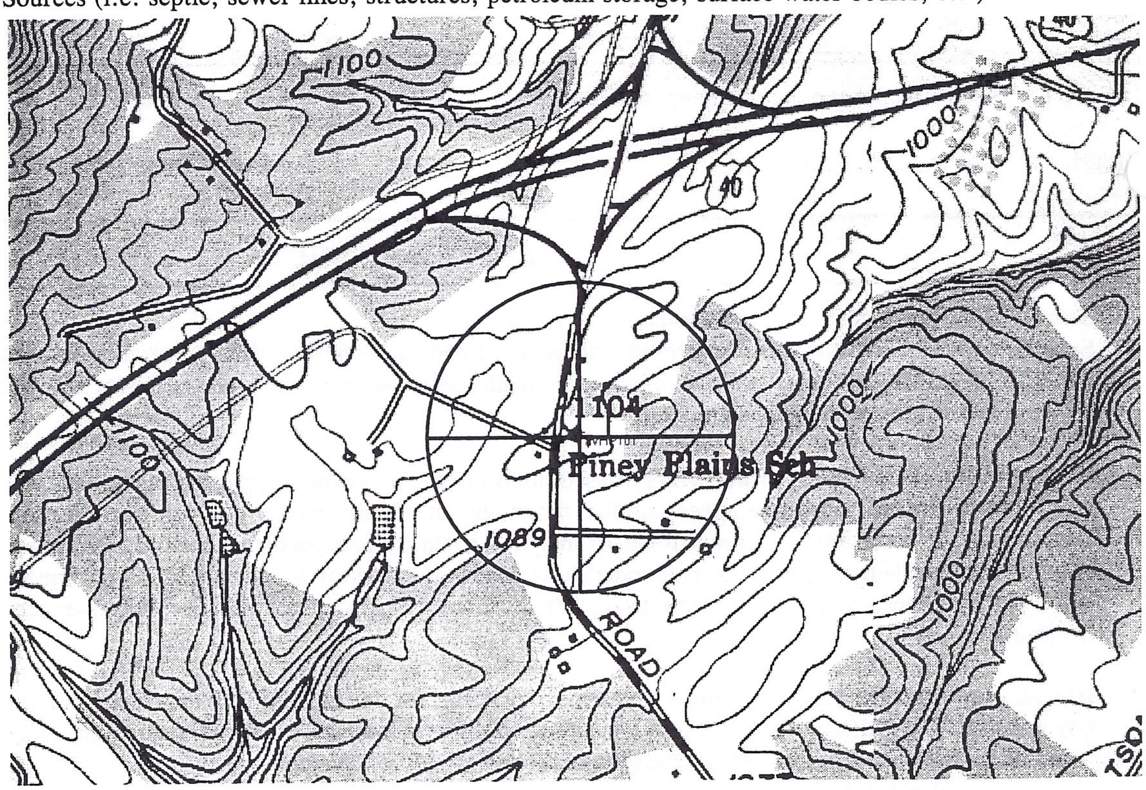
22. Well Information:

Tag Number: not visible
Year Drilled: ______
Casing Depth: ______
Well Depth: ______
Well Yield: ______
Casing Height: ______
Grout Depth: ______
Pitless Adapter? ______
Wiring OK? unknown
Pump OK? unknown

23. Well Type:

Drilled __x____
Driven ______
Dug ______

24. Well Location Diagram (1 in. = 1250 ft.) with Approximate Distances from Potential Contaminant Sources (i.e. septic, sewer lines, structures, petroleum storage, surface water bodies, etc.):



25. Aquifer:

Name: Devonian
GAP #: ____________
Confined ______
Unconfined __x____
Semi-confined ______

26. Quantity Used:

Daily Avg (gpd) <300
Pumping Rate (gpm) 5 - 10
Hours run per day ______

27. Well Cap:

Type? ______
Seal Tight? O.K.
Vented? O.K.
Screened? No
Conduit OK? O.K.

28. Casing Diameter:

2" ______
4" ______
6" __x____
Other ______

29. Casing Type:

PVC ______
Metal __x____
Concrete______